

REMARKS

Claims 1-8 are pending in the application with claims 1 and 8 being the independent claims. None of the claims are amended, but are provided for reference by the Examiner.

Objection to the Drawings

The Examiner objected to FIGs. 6-8 as describing conventional plasma processing apparatuses. The Examiner requires that they be labeled prior art. With this Amendment, Applicant submits revised drawing sheets of FIGs. 6-8 including a legend designating them as prior art.

Objection to the Specification

The Examiner objected to the Specification as having non-idiomatic phrasing and requested that it be corrected. The Examiner requested that support for any corrections be pointed to in the record. Applicant amends the paragraph beginning on page 4, line 12 and the paragraph beginning on page 7, line 10. Support for these changes can be found, *inter alia*, within those same paragraphs and on page 9, line 27-page 10, line 1.

Examiner Interview

Applicant and Applicant's undersigned representative thank the Examiner for taking the time to meet for an Examiner's Interview on August 13, 2003. As recorded on the Examiner Interview Summary Record, a tentative agreement was reached regarding the rejections based on the cited art. The Examiner indicated that the presentation of arguments and/or a declaration directed to the reasoning for the Examiner's two underlying presumptions would place the claims in a condition for allowance as they currently stand. With these Remarks, Applicant submits a

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Declaration signed by the inventor overcoming the two presumptions relied upon by the Examiner in rejecting the claims.

Background and Description of the Invention

Typical plasma processing apparatuses are designed to keep the apparatus footprint at a minimum and to maintain low costs by connecting multiple processing units to a common transfer chamber. The plasma processing apparatus may include a wave guide associated with each processing unit. Within each processing unit, plasma concentrations are affected by the position of the wave guide relative to the unit, and by any bends in the wave guide. Because the wave guides in a typical system are oriented to maintain a small footprint, for convenience of operation, or to minimize costs, the wave guide for each unit may not be located in the same position with respect to the processing unit, or a wafer in the processing unit. Accordingly, separate wafers processed in separate processing units have different areas of plasma concentrations.

The present invention provides substantially the same plasma concentrations on the wafers regardless of which processing unit the wafers are treated in, resulting in consistently manufactured wafers. To achieve consistent plasma concentrations between units, the wave guide on each processing unit is oriented in the same direction relative to the path of the wafer as it is loaded in the processing unit.

Rejection Under 35 U.S.C. § 103

Wagner in view of Sato or Yamazaki, and in further view of Kanekiyo

Claims 1-8 stand rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,177,129 to Wagner *et al.* in view of U.S. Patent No. 6,306,765 to Sato or U.S. Patent No. 5,976,259 to Yamazaki, and in further view of Kanekiyo. Claim 1 is

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directed to a plasma processing apparatus having a bent wave guide, including a plurality of plasma processing units. Each plasma processing unit includes a vacuum processing chamber having a mounting stage for mounting a substrate with a fixed reference point. Each plasma processing unit also includes a wave guide bent at an angle for introducing high frequency waves into the vacuum processing chamber for converting process gas to plasma by high frequency waves and processing the substrate by the plasma. A common transfer chamber is airtightly connected to the plurality of plasma processing units and includes a transfer arm adapted to transfer the substrate to the mounting stage in a transfer direction that is fixed for each of the plurality of plasma processing units. The transfer arm is also adapted such that the reference point of the substrate is always positioned the same with respect to the transfer arm. For each of the plurality of plasma processing units, the position of the wave guide in relation to the transfer direction of the transfer arm is the same.

Claim 8 is directed to a plasma processing method for performing a predetermined process for a substrate by a plasma processing apparatus having a bent wave guide. The apparatus comprises a plurality of plasma processing units, each having a vacuum processing chamber including a mounting stage for mounting a substrate with a fixed reference point. The plasma processing unit also includes a wave guide bent at an angle for introducing high frequency waves into the vacuum processing chamber for converting process gas to plasma by high frequency waves and processing the substrate by the plasma. A common transfer chamber is airtightly connected to the plurality of plasma processing units and includes a transfer arm. The transfer arm transfers the substrate to the mounting stage in a transfer direction that is fixed for each

of the plurality of plasma processing units. For each of the plasma processing units, the position of the wave guide in relation to the transfer direction of the transfer arm is the same. The method includes the steps of transferring the substrate with the reference point to the mounting stages of the plasma processing units from the transfer chamber. The reference of the substrate is positioned the same in each of the plasma processing units with respect to the wave guide. The method also includes the step of performing a plasma process for the substrate while the position of the reference point of the substrate in relation to the wave guide is kept the same for each of the plasma processing units.

The art cited by the Examiner, alone or in combination, does not establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference(s) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). See MPEP § 2143.

Using an applicant's disclosure as a blueprint to reconstruct the claimed invention from isolated pieces of the prior art references contravenes the statutory mandate of § 103, which requires determining obviousness at the time the invention was made. See *Grain Processing Corp. v. American Maize-Prods. Co.*, 840 F.2d 902, 907, 5 U.S.P.Q.2d 1788, 1792 (Fed. Cir. 1988).

Nothing in any of the references cited provides a suggestion or motivation to modify the references in a manner that would arrive at the claimed plasma processing apparatus. The Examiner relies upon two presumptions as the motivation to modify the only reference having a common transfer chamber (Wagner) to include bent wave guides, and as the motivation to orient the bent wave guides "for each of said plurality of plasma processing units [so that] the position of said wave guide in relation to said transfer direction of said transfer arm is the same." The first presumption is that an engineer would logically position the bent wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to maximize separation of the chambers and wave guides to minimize interference and prevent distortion of each unit's electric field (see Office Action of July 7, 2003 at 5). The second presumption is that an engineer would logically position the bent wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to prevent physical hindrance of the structures (see id.). Relying upon these two presumptions, the Examiner maintains that the present claims would be obvious.

With this Amendment, Applicant provides a Declaration Under 37 C.F.R. § 1.132 rebutting each of the presumptions relied upon the Examiner by showing that all the features of claims 1 and 8, including a bent wave guide in the position claimed, would not be obvious to one skilled in the art. First, the Declaration addresses and rebuts the first presumption relied upon by the Examiner, namely, that an engineer would logically position the bent wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to maximize separation of

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the chambers and wave guides to minimize interference and prevent distortion of each unit's electric field (see Office Action at 5).

Plasma processing systems are designed so that the magnetic field of one plasma processing chamber does not affect the plasma deposition in other processing chambers, and likewise, does not overly affect the travel path of microwaves in wave guides of other plasma processing chambers. Additionally, passing microwaves through one wave guide does not generate an electrical or mechanical field that would overly affect the travel path of microwaves in an alternate wave guide. Because of this, during design of a plasma processing apparatus, an engineer of ordinary skill in the art would not be motivated to position the bent wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to maximize separation of the chambers and wave guides to minimize interference and prevent distortion of each unit's electric field. Instead, an engineer considers many factors in designing a plasma processing apparatus, and an engineer may, in fact, design a plasma processing apparatus with a bent wave guide having the configuration shown in FIGs. 6 and 7.

The Specification of the present application explains that the electric field distribution of waves introduced from the wave guide, and the plasma concentration on the substrate resulting therefrom, varies within each plasma processing unit according to the position of the wave guide in relation to the substrate. See Specification, page 2, line 30-page 3, line 25. This problem of a non-uniform electric field distribution described in the specification is mainly caused by the bend in the wave guide.

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The plasma processing apparatus described and claimed in the present application includes several different elements. Some of these are: a transfer arm adapted to transfer a substrate to a mounting stage in a transfer direction that is fixed for each of the plasma processing units; a reference point of the substrate is always positioned the same with respect to the transfer arm; and for each of the plasma processing units, the position of the wave guide in relation to said transfer direction of the transfer arm is the same. Together, these features establish a consistent position of the wave guide relative to the transfer direction of the transfer arm and relative to the reference point of the substrate for each plasma processing unit. Therefore, according to the present invention, the position of the wave guide in relation to a reference point on the substrate is the same for each of the plasma processing chamber units. Because of this, the deviation of the electric field intensity distribution in each unit is consistent with respect to the substrate transferred between units. See Specification, page 4, lines 12-23.

Because the non-uniform electric field distribution is not caused by interference from other processing chambers, it does not logically follow that one would position the bent wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit to avoid interference between units.

Applicant also rebuts the second presumption, namely, that an engineer would logically position the wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to prevent physical hindrance of the structures. As set forth in the attached Rule 132 Declaration, an engineer having ordinary skill in the art would rely upon many factors to determine the

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placement of the wave guide. For example, overall footprint and cost of manufacturing are two factors considered in determining the design of plasma processing systems. A footprint is the surface area covered by the system. An engineer having ordinary skill in the art would consider the overall footprint of a plasma processing system to be at least one motivating factor to position each wave guide in relation to a transfer direction of a transfer arm so that it is not the same for each plasma processing unit. In fact, the background section of the present application describes a conventional plasma processing apparatus as an example of this.

In order to minimize the footprint and manufacturing costs, some conventional processing apparatuses have the configuration described in FIGs. 6 and 7. See Specification, page 1, lines 21-25. In FIGs. 6 and 7, the position of the wave guide in relation to the transfer direction of the transfer arm is not the same for each of the plasma processing units. Accordingly, the background section of the specification provides reasons that an engineer would not position the wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to prevent physical hindrance of the structures. In fact, the wave guides may be positioned in any of a limitless number of other positions that prevent physical hindrance of the structures, including that shown in FIGs. 6 and 7. Accordingly, the proposition that an engineer of ordinary skill in the art would position the wave guide in relation to the transfer direction of the transfer arm so that it is the same for each plasma processing unit in order to prevent physical hindrance of the structures is not correct, as many factors are used to determine wave guide placement.

To establish a *prima facie* case of obviousness, the Examiner must provide a motivation to combine the reference teachings. The attached declaration addresses the Examiner's reasoning that a plasma processing apparatus engineer would take the separate features of Wagner, Sato, Yamazaki, and Kanekiyo and arrange them to arrive at the claimed plasma processing apparatus as recited in independent claims 1 and 8. Specifically, it would not be obvious to arrange the various components to arrive at the claimed plasma processing apparatus including all the features as claimed with a bent wave guide and reciting "wherein for each of said plurality of plasma processing units, the position of said [bent] wave guide in relation to said transfer direction of said transfer arm is the same."

Even if there were a suggestion or motivation to combine, the references still fail to establish a *prima facie* case of obviousness because the combination of references applied by the Examiner fails to teach or suggest all the claim limitations. Claims 1 and 8 recite a plasma processing apparatus having all the claimed features, including a bent wave guide and that "for each of said plurality of plasma processing units, the position of said [bent] wave guide in relation to said transfer direction of said transfer arm is the same." None of the references teaches or suggests such a configuration. The Examiner stated that "Sato and Yamazaki both illustrate transferring a substrate from one identical microwave plasma chamber to another without changing the configuration of the substrate relative to the microwave plasma chamber." See Office Action at 4 (emphasis in original). The Examiner relies upon Kanekiyo to show a bent wave guide. But even if the Examiner is correct in stating that Sato and Yamazaki transfer a substrate from one identical plasma chamber to another, and that Kanekiyo has a bent

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wave guide, it does not necessarily follow that the position of the bent wave guide in relation to the transfer direction of the transfer arm is the same. There is no teaching that the bent wave guide would be positioned the same relative to the transfer direction, especially when the claims also recite a common transfer chamber. The combination of the cited references suggests nothing more than is discussed in the background section of the application, as set forth above. Accordingly, the Examiner has not established a *prima facie* case of obviousness. Claims 1 and 8 are allowable over this combination of references.

Claims 2-7 depend from and add additional features to independent claim 1. Accordingly, these claims are also allowable for at least the reasons set forth above. Applicant respectfully requests that the Examiner withdraw the rejection and allow these claims.

Wagner in view of Sato or Yamazaki, and in further view of Kanekiyo, and further in view of Jeng *et al.* or Maydan *et al.* or Maher *et al.*

The Examiner also rejected claims 1-8 under 35 U.S.C. § 103 as unpatentable over Wagner in view of Sato or Yamazaki, and in further view of Kanekiyo, and further in view of U.S. Publication No. 2002/0084032 to Jeng *et al.* or U.S. Patent No. 5,292,293 to Maydan *et al.* or U.S. Patent No. 6,413,320 to Maher *et al.*

The Examiner relies upon Jeng, Maydan, or Maher for an asserted teaching of identical placement of substrates as they are moved between chambers. Claims 1 and 8 recite a plasma processing apparatus having many features including bent wave guides and that "for each of said plurality of plasma processing units, the position of said wave guide in relation to said transfer direction of said transfer arm is the same."

The cited combination of references fails to teach or suggest such features for all the reasons set forth above. Accordingly, the art cited, in any combination, fails to render unpatentable the invention recited in claims 1 and 8. Accordingly, claims 1 and 8 are patentable over this combination of references.

Claims 2-7 depend from and add additional features to independent claim 1. Accordingly, these claims are also allowable for at least the reasons set forth above. Applicant respectfully requests that the Examiner withdraw the rejection and allow these claims.

Conclusion

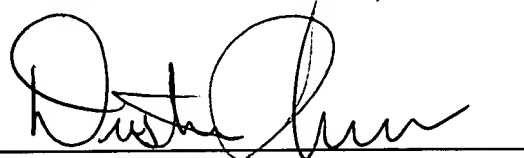
In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: Oct. 31, 2003

By: 
Dustin T. Johnson
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Attachments: Two Replacement Sheets, showing FIGs. 6-8; and
Declaration Under 37 C.F.R. § 1.132

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